GB04/4636

INVESTOR IN PEOPLE

The Patent Office
Concept House
Cardiff Road
Newport
South Wales
NP10 8QQ

RECD 07 JAN 2005
WIPO PCT

PRIORITY DOCUMENT

SUBMITTED OR TRANSMITTED IN COMPLIANCE WITH RULE 17.1(a) OR (b)

I, the undersigned, being an officer duly authorised in accordance with Section 74(1) and (4) of the Deregulation & Contracting Out Act 1994, to sign and issue certificates on behalf of the Comptroller-General, hereby certify that annexed hereto is a true copy of the documents as originally filed in connection with the patent application identified therein.

I also certify that the application is now proceeding in the name as identified herein.

I also certify that the attached copy of the request for grant of a Patent (Form 1/77) bears an amendment, effected by this office, following a request by the applicant and agreed to by the Comptroller-General

In accordance with the Patents (Companies Re-registration) Rules 1982, if a company named in this certificate and any accompanying documents has re-registered under the Companies Act 1980 with the same name as that with which it was registered immediately before re-registration save for the substitution as, or inclusion as, the last part of the name of the words "public limited company" or their equivalents in Welsh, references to the name of the company in this certificate and any accompanying documents shall be treated as references to the name with which it is so re-registered.

In accordance with the rules, the words "public limited company" may be replaced by p.l.c., plc, P.L.C. or PLC.

Re-registration under the Companies Act does not constitute a new legal entity but merely subjects the company to certain additional company law rules.

Signed

Dated 9 December 2004

BEST AVAILABLE COPY

The Patent Office

INVESTOR IN PEOPLE

GB0325775.5

By virtue of a direction given under Section 30 of the Patents Act 1977, the application is proceeding in the name of

STERITROX LIMITED,
Cromwell Road,
Bredbury,
STOCKPORT,
Cheshire,
SK6 2RH,
United Kingdom

Incorporated in the United Kingdom

[ADP No. 08909053001]

tents Form 1/77

ts Act 1977
(R 6)

The Patent Office · PATENTS · DESIGNS · COPYRIGHT · TRADE MARKS

05NOV03 E849629-1 B17867
P01/7700 0.00-0325775.5

THE PATENT OFFICE
J
- 5 NOV 2003
NEWPORT

The Patent Office

Cardiff Road
Newport
South Wales
NP10 8QQ

Request for grant of a patent

(See the notes on the back of this form. You can also get an explanatory leaflet from the Patent Office to help you fill in this form)

1. Your reference — AM/VWASH/03

2. Patent application number *(The Patent Office will fill this part in)* — 0325775.5

   SECTION 30 (1977) APPLICATION FILED 30/6/04

3. Full name, address and postcode of the or of each applicant *(underline all surnames)*

   ALAN MOLE
   LABURNUM COTTAGE
   STATION RD
   ELKINGTON
   PERSHORE WR10 3BB

   Patents ADP number *(if you know it)* — 7037765003

   If the applicant is a corporate body, give the country/state of its incorporation

4. Title of the invention — PRODUCE DECONTAMINATION DEVICE

5. Name of your agent *(if you have one)*

   "Address for service" in the United Kingdom to which all correspondence should be sent *(including the postcode)*

   ~~ALAN MOLE~~
   ~~PROMANADE LTD~~
   ~~UPPER END~~
   ~~BIRLINGHAM~~
   ~~PERSHORE WR10 3AA~~

   MARKS & CLERK
   27 IMPERIAL SQUARE
   CHELTENHAM
   GLOUCESTERSHIRE
   GL50 1RQ
   18014

   AB
   51/77
   1/7/04

   Patents ADP number *(if you know it)* — 7037765003

6. Priority: Complete this section if you are declaring priority from one or more earlier patent applications, filed in the last 12 months.

Country	Priority application number *(if you know it)*	Date of filing *(day / month / year)*

7. Divisionals, etc: Complete this section only if this application is a divisional application or resulted from an entitlement dispute (see note f)

Number of earlier UK application	Date of filing *(day / month / year)*

8. Is a Patents Form 7/77 (Statement of inventorship and of right to grant of a patent) required in support of this request? — NO

   Answer YES if:
   a) any applicant named in part 3 is not an inventor, or
   b) there is an inventor who is not named as an applicant, or
   c) any named applicant is a corporate body.

   Otherwise answer NO (See note d)

Accompanying documents: A patent application must include a description of the invention. Not counting duplicates, please enter the number of pages of each item accompanying this form:

Continuation sheets of this form	NIL
Description	2
Claim(s)	1
Abstract	1
Drawing(s)	1

10. If you are also filing any of the following, state how many against each item.

Priority documents

Translations of priority documents

Statement of inventorship and right to grant of a patent (Patents Form 7/77)

Request for a preliminary examination and search (Patents Form 9/77)

Request for a substantive examination (Patents Form 10/77)

Any other documents (please specify)

11. ~~I/We~~ request the grant of a patent on the basis of this application.

Signature(s) A. Mole   Date 4.11.03

12. Name, daytime telephone number and e-mail address, if any, of person to contact in the United Kingdom   ALAN MOLE   almco99@yahoo.co.uk   01386 750284

Warning

After an application for a patent has been filed, the Comptroller of the Patent Office will consider whether publication or communication of the invention should be prohibited or restricted under Section 22 of the Patents Act 1977. You will be informed if it is necessary to prohibit or restrict your invention in this way. Furthermore, if you live in the United Kingdom, Section 23 of the Patents Act 1977 stops you from applying for a patent abroad without first getting written permission from the Patent Office unless an application has been filed at least 6 weeks beforehand in the United Kingdom for a patent for the same invention and either no direction prohibiting publication or communication has been given, or any such direction has been revoked.

Notes

a) If you need help to fill in this form or you have any questions, please contact the Patent Office on 08459 500505.

b) Write your answers in capital letters using black ink or you may type them.

c) If there is not enough space for all the relevant details on any part of this form, please continue on a separate sheet of paper and write "see continuation sheet" in the relevant part(s). Any continuation sheet should be attached to this form.

d) If you have answered YES in part 8, a Patents Form 7/77 will need to be filed.

e) Once you have filled in the form you must remember to sign and date it.

f) Part 7 should only be completed when a divisional application is being made under section 15(4), or when an application is being made under section 8(3), 12(6) or 37(4) following an entitlement dispute. By completing part 7 you are requesting that this application takes the same filing date as an earlier UK application. If you want the new application to have the same priority date(s) as the earlier UK application, you should also complete part 6 with the priority details.

Produce decontamination by free radical washing.
According to the present invention there is a device utilising electronically generated free radicals in the presence of non condensing humidity applied to typically but not restricted to fresh produce such as salad products or herbs presented upon a moving belt within a partially enclosed chamber.

BACKGROUND
Traditionally, fresh produce post harvest is washed with a solution containing a biocide such as chlorine or chlorine dioxide, or ozone or any number of combinations of chemicals, with the express aim of reducing or removing potentially damaging or pathogenic microorganisms.

The use of chemicals within the food chain is now less acceptable than hitherto, and many chemical biocides are now proscribed or severely limited by legislation.
Traditional sanitisation or decontamination uses vast quantities of water; the present invention is designed to use only minimal quantities of water.

PRINCIPLE
The present invention uses only air and potable water to create an environment rich in free radicals such as hydroxyl radicals (OH•, OH⁻) and singlet Oxygen (O•). These radicals are very powerful oxidising agents, indiscriminate in activity but powerfully biocidal; therefore require accurate and effective control systems for use in a decontamination device. For applications requiring extra decontamination activity the invention incorporates a mechanism for introducing ferric ions into the water supplying the humidity, thereby utilising the well-known phenomenon of Fenton's Reaction. The volume of water necessary to create the required conditions is restricted by design to two to four litres per hour per sprayhead. This means that a chamber containing say twenty sprayheads will use no more than 80 litres of water per hour. Such a chamber could typically decontaminate several hundred kilograms of produce in that time, compare with typically a traditional herb washing plant using 3000 litres of chlorinated water per 500 kg per hour.

Fenton's Reaction and Ozone
Ozone in solution breaks down rapidly to form hydrogen peroxide (H_2O_2), which then forms the peroxide radical HO-OH, then two hydroxyl radicals OH• and OH^-. The rate of conversion from hydrogen peroxide to hydroxyl radical can be greatly enhanced in the presence of ferric ions, acting as a form of catalyst in their conversion to ferrous ions, according to the formula:

$$H_2O_2 + Fe^{2+} = OH\bullet + OH^- + Fe^{3+}$$

The surface of any produce being treated is exposed to the spray containing ferric ions, which coats the surface of the produce with a few microns of water, this is then immediately exposed to the ozone containing spray which ensures the free radical generation is strongest on the surface, where the two sprays combine.

Description
According to the present invention, and with reference to the accompanying diagram, a chamber (12) is constructed incorporating two conveyor devices (8a and 8b) set and aligned to provide partial superimposition one above the other. Above both conveyors and vertically between them, (at the point of superimposition) is provided a series of sprayheads (5), producing a fine mist of water droplets of a size between 1 and 15 microns, with an average size of 5 microns. The arrangement of these sprayheads is such that the water droplets issued will form a dense layer extending upwards so far as is necessary to ensure that any product on

the conveyor is immersed in the layer. Alternate sprayheads provide first ozonised water and the second, water with ferric ions and so on, repeated for the length of the conveyors and vertical drop sprayheads (6).
Superimposed above the sprayheads is a group of waterproof fluorescent tubes (2) producing ultraviolet (UV) light at wavelengths of 185 and 253.7 nanometres. The internal surfaces of the chamber (12) are coated with a compound containing titanium oxides and dioxides.
The lower of the two conveyors (8b) incorporates a mechanism (7) to enable the raising or lowering of the conveyor in relation to the upper conveyor. The sprayheads and fluorescent tubes are fitted to enable a constant relationship with the conveyor whatever conveyor position is set.
Further fluorescent tubes (3) of similar specification are located within the chamber to ensure that all surfaces of product are at some point exposed to the light emitted.

The water supplying the sprayheads (5) is provided from reservoirs (4) containing pumps (13,16) to feed the sprayheads (5) at the appropriate pressure to ensure proper atomisation. The water supply from the pump (3) passes through a venturi (15) or similar device for introducing ozone gas under pressure from an ozone generator (14) to create an ozone concentration in the water of 1-5parts per million. The water supply from the pump (16) may be charged with a sufficient dose of ferric salts such as Ferric sulphate towards a final concentration of typically, but not restricted to, 10 to 15 parts per million. The sprayheads are arranged so that the first sprays a solution of ferric ions, the second a solution of ozone and so on for the length of the conveyors.

Operation of the device.
In operation, produce is introduced into the chamber through an orifice (9) and on to the conveyor (8a) ozonised water in droplets averaging 5 microns is produced from the sprayheads (5) in a dense layer completely enveloping the produce on the conveyor. The ozone rapidly breaks down in the presence of the light from the fluorescent tubes (2) at 253.7 nanometres to produce free radicals and hydrogen peroxide which then breaks down in the presence of ferric ions from the alternate sprayheads(5a) to produce hydroxyl radicals.

The produce moves through the chamber (12) at a rate that may be controlled by varying the speed of the conveyors (8a and 8b). On reaching the end of conveyor (8a) the produce then drops for a variable distance (7) according to the preset height of conveyor (8b). As the produce falls the vertical sprayheads (6) ensure that all surfaces are covered with spray and exposed to the UV light. Where the produce is robust the distance (7) may be increased up to maximum, where the produce is tender the distance (7) may be reduced by elevating the conveyor (8b) to minimise the physical effects of the drop.

The spray and UV exposure process continues for the length of conveyor (8b). On reaching the end of conveyor (8b) the produce exits the chamber via orifice (10) into a suitable receptacle.
In order to control any off gases from the device air is drawn from the chamber at (1) and recirculated through the reservoir (4). This creates a slight negative pressure within the chamber (12) to ensure that no off gas can escape as air is drawn in to the chamber at (11).

The internal surfaces of the chamber (12) are coated with catalytic materials based on titanium oxides and dioxides, which catalyse the breakdown of ozone to free radicals in the presence of UV light at 185 and 253.7nanometres from the fluorescent tubes (3). This ensures that no contamination can build up within the confines of the chamber.

Claims

1] A device for decontamination of produce utilising free radicals

2] A device as in claim one for decontamination of the surface of products

3] A device as in claims 1 and 2 where free radicals are generated by the catalytic decomposition of ozone and hydrogen peroxide

4] A device as in claims 1 to 3 where the free radical generation is from the catalytic effect of metals and metallic oxides and dioxides in the presence of ultra-violet light and oxygen

5] A device as in claims 1 to 4 where free radical generation is by the catalysed decomposition of ozone and hydrogen peroxide in the presence of ultra-violet light.

6] A device as in claims 1 to 5 where ozone is provided from a separate proprietary ozone generator

7] A device as in claims 1 to 6 where ozone is electrically generated within the water supply by means of pulsed capacitive discharge directly in the water.

8] A device as in claims 1 to 7 where hydrogen peroxide is electrically generated within the water supply by means of pulsed capacitive discharge directly in the water

9] A device as in claims 1 to 8 where nebulised sprays of water with a particle size not greater than 30 microns are generated within a partially enclosed chamber

10] A device as in claims 1 to 9 where nebulised water sprays are dosed with ozone and hydrogen peroxide in solution

11] A device as in claims 1 to 10 where nebulised sprays are dosed with a solution of ferric ions from typically but not restricted to ferric sulphate solution

12] A device as in claims 1 to 11 where excess ozone is removed by the application of ultra-violet light at the apertures

13] A device as in claims 1 to 12 incorporating a moving belt or series of moving belts for conveying products to be decontaminated through a partially enclosed chamber

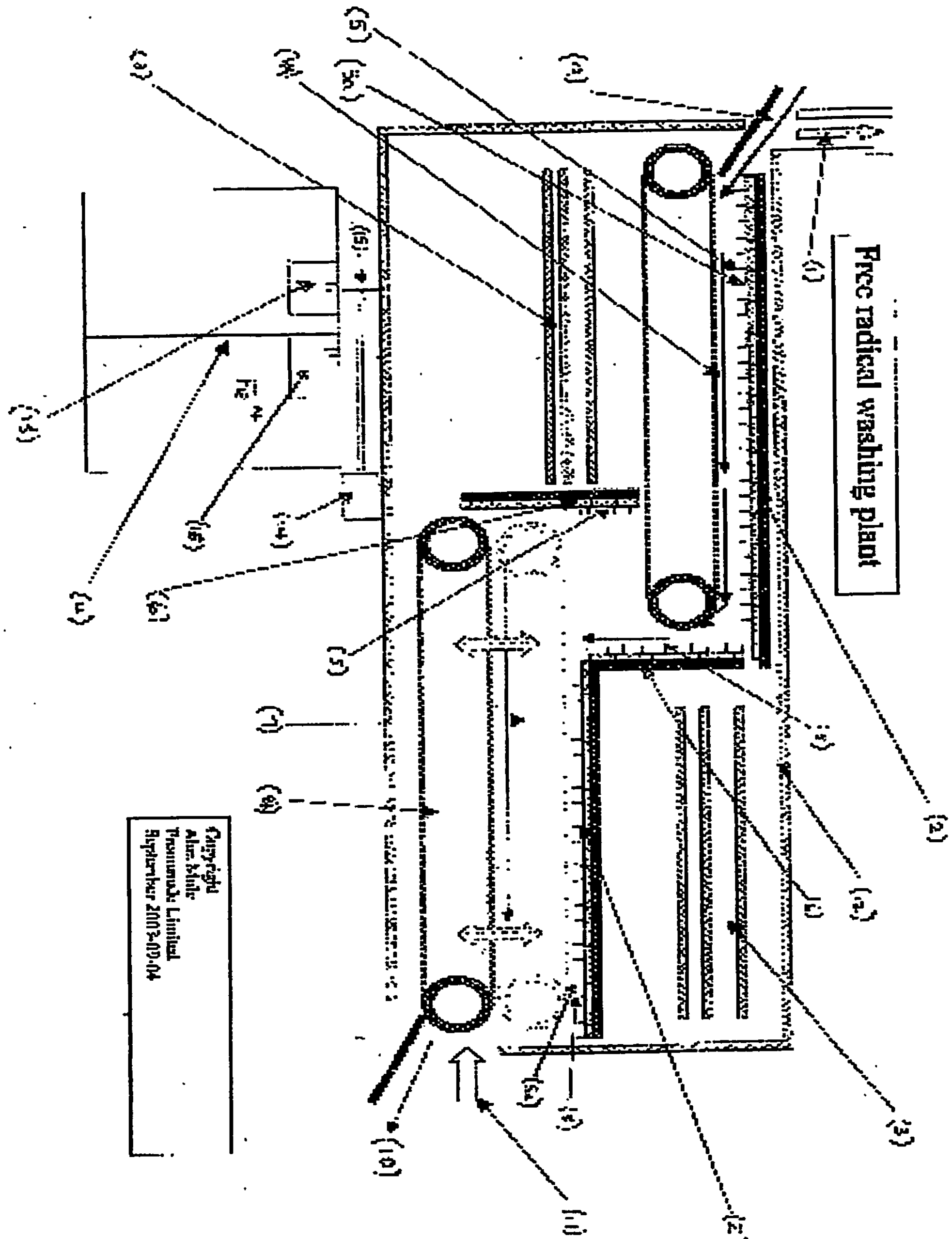
14] A device as in claims 1 to 13 where moving belts may be partially superimposed to create a dropping distance for products surfaces to be wholly decontaminated

15] A device as in claims 1 to 14 where the speed of the moving belts may be remotely adjusted by electronic means.

16] A device as in claims 1 to 15 which will destroy surface contaminants such as bacteria, viruses, yeasts, moulds, mycoplasmas, protozoa, and pesticides.

Abstract

A device for the bulk decontamination of produce and products using electrically generated free radicals within an enclosure, whilst minimising water consumption and using minimal chemicals only as catalysts, with the primary purpose being the destruction of surface contaminants such as bacteria, viruses, moulds, yeasts, protozoa and pesticides.


Free radical washing plant

PCT/GB2004/004636

This Page is Inserted by IFW Indexing and Scanning Operations and is not part of the Official Record.

BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images include but are not limited to the items checked:

- ☑ **BLACK BORDERS**
- ☐ **IMAGE CUT OFF AT TOP, BOTTOM OR SIDES**
- ☐ **FADED TEXT OR DRAWING**
- ☐ **BLURRED OR ILLEGIBLE TEXT OR DRAWING**
- ☐ **SKEWED/SLANTED IMAGES**
- ☐ **COLOR OR BLACK AND WHITE PHOTOGRAPHS**
- ☐ **GRAY SCALE DOCUMENTS**
- ☑ **LINES OR MARKS ON ORIGINAL DOCUMENT**
- ☑ **REFERENCE(S) OR EXHIBIT(S) SUBMITTED ARE POOR QUALITY**
- ☐ **OTHER:** ______________________

IMAGES ARE BEST AVAILABLE COPY.
As rescanning these documents will not correct the image problems checked, please do not report these problems to the IFW Image Problem Mailbox.